

WE CLAIM:

1. A microwave unit for processing a tissue specimen of less than about three millimeters for histology comprising:

- (a) a source which generates microwave radiation as a form of energy,
- (b) a waveguide which transmits the microwave radiation, and
- (c) a first reaction chamber which receives the microwave radiation, wherein at least a first chemical composition and the tissue specimen in contact therewith are surrounded within walls of the first reaction chamber;

wherein the microwave radiation is transmitted from the source to the first reaction chamber by the waveguide, the first reaction chamber has an interior configuration which provides a substantially uniform distribution of temperature therewithin due to the energy of the microwave radiation, the first chemical composition is brought from a first storage chamber to the first reaction chamber, and the tissue specimen is at least initially hardened by the first chemical composition, the microwave radiation, or both.

2. The microwave unit of Claim 1 further comprising:

- (d) a closure adapted to isolate the first reaction chamber,
- (e) thermal insulation surrounding the first reaction chamber,
- (f) an agitator within the first reaction chamber to promote chemical exchange between the tissue specimen and the first chemical composition, and
- (g) a port adapted to fill the first reaction chamber with the first chemical composition from the first storage chamber and to empty the first reaction chamber.

3. The microwave unit of Claim 1, wherein the temperature of a solution within the first reaction chamber is maintained between about 50°C and about 70°C.

4. The microwave unit of Claim 1, wherein the first chemical composition is a non-aqueous solution comprised of a fixative and a dehydrating agent.

5. The microwave unit of Claim 4, wherein the non-aqueous solution is comprised of a ketone and an alcohol.

6. The microwave unit of Claim 5, wherein the non-aqueous solution has a volume ratio of alcohol to ketone in a range between about 1:3 and 3:1.

7. The microwave unit of Claim 4, wherein the non-aqueous solution is further comprised of polymers between about 100 and 500 average molecular weight and a surfactant.

8. The microwave unit of Claim 4, wherein the tissue specimen is brought into contact with a series of at least two different chemical compositions which are non-aqueous solutions comprised of a ketone and an alcohol, wherein the volume ratio of alcohol to ketone changes between at least two non-aqueous solutions of the series.

9. The microwave unit of Claim 1, wherein the tissue specimen is substantially hardened by a plurality of different chemical compositions, the microwave radiation, or both.

10. The microwave unit of Claim 1, wherein the tissue specimen is substantially hardened in less than about 30 minutes.

11. The microwave unit of Claim 1, wherein the tissue specimen is substantially hardened in less than about two hours.

12. The microwave unit of Claim 1, wherein the source is a magnetron generating microwave radiation with a frequency between 2425 and 2575 megahertz.

13. The microwave unit of Claim 1, wherein the interior configuration comprises a whispering gallery mode which provides substantially uniform distribution of temperature in a solution within the first reaction chamber.

14. The microwave unit of Claim 1 comprising a plurality of reaction chambers, each of said reaction chambers being connected by the waveguide to the source.

15. A system for processing a tissue specimen of less than about three millimeters for histology comprising a plurality of modules each comprised of a reaction chamber and a chemical composition contained therein, wherein the tissue specimen is processed by being brought into contact with each chemical composition in the reaction chamber of each module:

- (a) at least one first module comprising a microwave unit of Claim 1, wherein at least a second chemical composition is brought from a second storage chamber to the first reaction chamber and the tissue specimen is thereby at least initially impregnated;
- (b) at least one second module comprising a second reaction chamber, wherein impregnation of the tissue specimen is substantially completed under less than atmospheric pressure within walls of the second reaction chamber; and
- (c) a conveyance which transfers the tissue specimen between a said first module and a said second module.

16. The tissue processor system of Claim 15, wherein the conveyance comprises a track connecting the said first module and the said second module.

17. The tissue processor system of Claim 15, wherein the conveyance comprises an armature connecting the said first module and the said second module.

18. The tissue processor system of Claim 15 further comprised of:

- (d) a closure adapted to isolate the second reaction chamber,
 - (e) thermal insulation surrounding the second reaction chamber,
 - (f) a heater which maintains wax in molten form in the second reaction chamber,
- and

(g) a port adapted to fill the second reaction chamber with a molten wax solution.

19. The tissue processor system of Claim 15, wherein the temperature of a solution within the second reaction chamber is maintained between about 50°C and about 70°C.

20. The tissue processor system of Claim 15, wherein the second chemical composition is a non-aqueous solution comprised of fixative, dehydrating agent, and impregnating agent.

21. The tissue processor system of Claim 15, wherein the second chemical composition is a non-aqueous solution comprised of a ketone, an alcohol, and mineral oil.

22. The tissue processor system of Claim 15, wherein there are at least four different chemical compositions in separate storage chambers in fluid communication with at least said first module and at least one said second module.

23. The tissue processor system of Claim 15, wherein there are at least two parallel series of modules of the (a) and (b) types, and transfer of tissue specimens within a series of modules is independently controlled.

24. The tissue processor system of Claim 15, wherein a tissue specimen is substantially impregnated by wax in less than about 25 minutes.

25. The tissue processor system of Claim 15, wherein a tissue specimen is substantially impregnated by wax in less than about two hours.

26. A microwave unit for tissue processing comprising:

(a) a source generating microwave radiation,

(b) a reaction chamber comprising an interior configured to provide a substantially uniform distribution of microwave radiation transmitted therein,

- (c) a waveguide transmitting the microwave radiation from the source to the reaction chamber,
- (d) a first storage chamber in fluid communication with the reaction chamber, wherein a first non-aqueous solution comprising an admixture of at least fixative and dehydrating agent is transferred between the first storage chamber and the reaction chamber, and
- (e) a second storage chamber in fluid communication with the reaction chamber, wherein a second non-aqueous solution comprising an admixture of at least fixative and dehydrating agent is transferred between the second storage chamber and the reaction chamber, and
- (f) a third storage chamber in fluid communication with the reaction chamber, wherein a third non-aqueous solution comprising an admixture of at least fixative, dehydrating agent, and impregnating agent is transferred between the third storage chamber and the reaction chamber;

wherein tissue hardening is at least initiated in the reaction chamber by contact with the first non-aqueous solution, the microwave radiation, or both; the volume ratio between dehydrating agent and fixative increases from the first non-aqueous solution to the second non-aqueous solution; tissue impregnation is at least initiated in the reaction chamber by contact with the third non-aqueous solution; and the reaction chamber further comprises an agitator and a heater which increase rates for tissue hardening and tissue impregnation.

27. The microwave unit of Claim 26 further comprising a multi-position rotary valve and a pump which controls fluid transfer between the storage chambers and the reaction chamber by pressure/vacuum cycles.

28. The microwave unit of Claim 26, wherein pressure within the reaction chamber is maintained above about 500 millimeters of Hg.